HOW TO READ A PAPER

What is a Paper?

The paper is a scholarly article that contains the results of original research or an evaluation of research conducted by others. The paper tells the story of the project from inception, through the data-collection process, statistical analysis, and discussion of the results. Writing, editing, and publishing the paper is the last step in the research process.

Why Do We Read Papers?

Researchers must read papers for several reasons: to review them for a conference or a class, to keep current in their field, or for a literature survey of a new field. A typical researcher will likely spend hundreds of hours every year reading papers.

Anatomy of a Research Paper

- Title
- Authors
- Key Words
- Corresponding Author
- Financial and Equipment Support
- Conflicts of Interest
- Abstract
- Introduction
- Methods
- Subjects
- Equipment
- Interventions or Study Procedures
- Data Analysis
- Results
- Discussion
- Conclusions
- Acknowledgements
- Summary

How to Read a Paper?

When you read a research paper, your goal is to understand the scientific contributions the authors are making. This is not an easy task. It may require going over the paper several times. Expect to spend several hours to read a paper.

Here are some initial guidelines for how to read a paper:

Read Critically:

Reading a research paper must be a critical process. You should not assume that the authors are always correct. Instead, be suspicious. Critical reading involves asking appropriate questions. If the authors attempt to solve a problem, are they solving the right problem? Are there simple solutions the authors do not seem to have considered? What are the limitations of the solution? Are the assumptions the authors make reasonable? If the authors present data, did they gather the right data to substantiate their argument, and did they appear to gather it in the correct manner? .. etc

Read Creatively:

Reading a paper critically is easy, in that it is always easier to tear something down than to build it up. Reading creatively involves harder, more positive thinking.
What are the good ideas in this paper? Do these ideas have other applications or extensions that the authors might not have thought of? Can they be generalized further? Are there possible improvements that might make important practical differences? If you were going to start doing research from this paper, what would be the next thing you would do?

Make Notes As You Read the Paper:

Many people cover the margins of their copies of papers with notes. Use whatever style you prefer. If you have questions or criticisms, write them down so you do not forget them. Underline key points the authors make. Mark the data that is most important or that appears questionable. Such efforts help the first time you read a paper and pay big dividends when you have to re-read a paper after several months.

Use A 3-Pass Approach:

The key idea of this approach is that you should read the paper in up to three passes, instead of starting at the beginning and plowing your way to the end. Each pass accomplishes specific goals and builds upon the previous pass: *The first pass* gives you a general idea about the paper. *The second pass* lets you grasp the paper's content, but not its details. *The third pass* helps you understand the paper in depth.

The first pass is a quick scan to get a bird's-eye view of the paper. You can also decide whether you need to do any more passes. This pass should take about five to ten minutes and consists of the following steps:
1. Carefully read the title, abstract, and introduction.

2. Read the section and sub-section headings, but ignore everything else.
3. Glance at the mathematical content (if any) to determine the underlying theoretical foundations.
4. Read the conclusions.
5. Glance over the references, mentally ticking off the ones you've already read.

Using this information, you may choose not to read further. This could be because the paper doesn't interest you, or you don't know enough about the area to understand the paper, or that the authors make invalid assumptions. The first pass is adequate for papers that aren't in your research area, but may someday prove relevant.

In ***the second pass***, read the paper with greater care, but ignore details such as proofs. It helps to jot down the key points, or to make comments in the margins, as you read.
1. Look carefully at the figures, diagrams and other illustrations in the paper. Pay special attention to graphs. Are the axes properly labeled? Are results shown with error bars, so that conclusions are statistically significant? Common mistakes like these will separate rushed, shoddy work from the truly excellent.
2. Remember to mark relevant unread references for further reading (this is a good way to learn more about the background of the paper).
The second pass should take up to an hour. After this pass, you should be able to grasp the content of the paper. You should be able to summarize the main thrust of the paper, with supporting evidence, to someone else. This level of detail is appropriate for a paper in which you are interested, but does not lie in your research speciality.

To fully understand a paper, particularly if you are reviewer, requires ***a third pass***. The key to the third pass is to attempt to virtually re-implement the paper: that is, making the same assumptions as the authors, re-create the work. By comparing this re-creation with the actual paper, you can easily identify not only a paper's innovations, but also its hidden failings and assumptions.
This pass requires great attention to detail. You should identify and challenge every assumption in every statement.
This pass can take about four or five hours for beginners, and about an hour for an experienced reader. At the end of this pass, you should be able to reconstruct the entire structure of the paper from memory, as well as be able to identify its strong and weak points. In particular, you should be able to pinpoint implicit assumptions, missing citations to relevant work, and potential issues with experimental or analytical techniques.

For Further Reading:

1. How to Read a Paper: The basics of evidence based medicine - Trisha Greenhalgh
2. How to Read a Paper - S. Keshav
3. http://www.bmj.com/about-bmj/resources-readers/publications/how-read-paper
4. http://www.tulane.net/publichealth/mchltp/upload/Anatomy-of-a-research-paper_KAT-2.pdf
5. http://www.eecs.harvard.edu/~michaelm/postscripts/ReadPaper.pdf

MENOUFIA FACULTY OF MEDICINE
STUDENT RESEARCH PROGRAM